REMARKS

Claims 1-41 remain now pending in the application. Favorable reconsideration is respectfully requested in view of the above amendments and the following remarks.

The allowance of claims 1-9 and the indication of allowable subject matter in claims 11-29 and 35-39 are noted with appreciation.

Claims 10, 30, 40, and 41 stand rejected under 35 U.S.C. §102(e) as allegedly being anticipated by Wilhelmsson et al. (EP 1 343 285 A1) (hereinafter "Wilhelmsson"). This rejection is respectfully traversed.

As a preliminary matter, it is noted that this rejection is purportedly based on 35 U.S.C. §102(e). However, the Wilhelmsson document does not qualify as prior art under that statute at least because it is neither "an application for patent ... *filed in the United States*" nor "*an international application* filed under the treaty defined in section 351(a)." As the publication date of Wilhelmsson (September 10, 2003) is less than one year earlier than Applicants' filing date (January 23, 2004), Applicants are treating this rejection as one based on 35 U.S.C. §102(a).

The invention relates to receivers used in communications systems in which groups of information bits to be transmitted are transformed into respective modulation symbols. When quadrature modulation is employed, the modulation symbols are mapped into streams of in-phase (I) and quadrature (Q) symbols that, after separate processing, are combined to form a signal that is transmitted. As an example, FIG. 3 of the present application depicts the constellation for a 16 Quadrature Amplitude Modulation (16QAM) signal. It can be seen that each symbol has a unique amplitude and phase on the I-Q number plane.

At the receiver, the modulated carrier signal is demodulated, meaning that it is processed to produce an estimate of the original information data stream intended for the receiver. When receiving signals modulated in the manner just described, the receiver's job is to determine which symbol, in the constellation of symbols, the received signal mostly likely represents. One aspect that presents a challenge is that the received signal no longer has exactly the same amplitude and/or phase characteristics that it had when it left the transmitter's antenna. These differences are due to distortions caused by the channel through which the signal passes from the transmitter's antenna to the receiver's antenna.

Consequently, one of the receiver's jobs is to associate each constellation point with a region on the I-Q number plane. It can then be determined which region the received signal falls in, and this information is helpful for demodulating the signal. Regions are separated

from one another by so-called "decision boundaries." For instance, as illustrated by the example presented in the application beginning on page 4, line 14, when receiving 16QAM-modulated symbols, the constellation of which is depicted in FIG. 3, the receiver has to determine the distance d between the Q-axis and the point on the I-axis that is half-way between the first and second columns of constellation points in the right half-plane in order to decide which symbols have been received. Because of symmetry of the constellation, the determined distance d separates all of the constellation points into a uniform pattern of squares.

As further explained in the specification, the distance d is proportional to the amplitude of the received signal, and that amplitude varies with time due to signal fading in the propagation channel. Thus, when the receiver is in a fading dip, the distance d is small, and when the receiver is in a fading peak, the distance d is large. Accordingly, the receiver must regularly update its determination of the distance d.

FIG. 4 shows a memory 410 after the combiner 406 that stores a number of complex symbols generated by the combiner. A decision boundary estimator 412 computes the distance d separately for each channelization code based on respective symbols in the memory 410 and on respective previously computed values of the distance d for each channelization code. Using the estimates of the distance d computed by the estimator 412, a soft bit value estimator 414 computes so-called soft bit values from the complex symbols stored in the memory 410.

Having the memory 410 between the combiner 406 and the decision boundary estimator 412 as in FIG. 4 is costly in several ways. For example, the memory size must be on the order of five kilobits, and this requires a corresponding area on one of the integrated circuit chips used for the receiver. Applicants' invention addresses this problem in embodiments that enable the memory to be eliminated.

More particularly, independent claim 10 defines "A method in a receiver of *determining decision boundary estimates* based on received symbols from one or more channelization codes, comprising the step of: *determining a decision boundary* for a respective channelization code *using* the received symbols *and at least one decision boundary estimate determined for another channelization code*." (Emphasis added.) Independent claim 40 defines a computer-readable medium having comparable features.

By using a previously-determined decision boundary estimate, in this case one that was determined for another channelization code, the need for the memory discussed above and in the Background section of the application (e.g., the memory 410) is eliminated.

The Office alleges that the Wilhelmsson document discloses all of the features defined by claims 10 and 40. These allegations are believed to be in error because Wilhelmsson does not disclose any technique "for determining *decision boundary estimates*", as defined by the claims. Rather, Wilhelmsson is concerned with calculating *soft values* for multilevel signals. The methods comprise approximating the log-likelihood values using only the dominant terms, so called max-log approximation; that is, for each bit position, only the two closest signal symbols of opposite bit value are considered in the sum. Two versions of approximation are disclosed: one version comprises using the two distances between the received value and the two closest symbols of opposite bit value. In order to simplify and speed up the calculation, the second version comprises using the distance between the two closest symbols to approximate the distance between the second closest symbol and the received value.

The Office's reliance on paragraphs 2, 6-8, and 58-66 in support of its allegations is unfounded because these paragraphs merely discuss techniques for generating soft bit values, not decision boundary estimates. It is noted that, in Wilhelmsson, decision boundaries are depicted in FIG. 2 (unlabeled) and in FIG. 7 (701, 702, 703, 704, 705, 706), and are mentioned in paragraph 61. However, there is no discussion of how they are generated. Rather, the decision boundaries are presented as already being known, and the discussion is focused on the generation of soft values. (See, e.g., the second sentence of paragraph 61: "Again, this embodiment utilizes the approximation of equation (7) *for the calculation of the soft values* L_m." (Emphasis added))

For at least the foregoing reasons, independent claims 10 and 40 are believed to be novel when considered in view of Wilhelmsson.

The Office further alleges that the subject matter defined by claims 30 and 41 is also anticipated by Wilhelmsson because "Wilhelmsson further discloses 'soft bit value estimates' in para. 61." These allegations are respectfully traversed.

Claims 30 and 41 depend from independent claims 10 and 40, respectively, and are novel over the Wilhelmsson patent for at least the reasons set forth above with respect to those base claims. Furthermore, these claims are novel over Wilhelmsson at least because they define determining soft bit value estimates "using received symbols and at least one

decision boundary estimate determined for another channelization code." (Emphasis added.) As mentioned earlier, Wilhelmsson does not discuss the generation of decision boundary estimates, and thus does not mention how they were determined with respect to generating any one soft bit value.

For at least the foregoing reasons, it is respectfully asserted that claims 10, 30, 40, and 41 are novel over the Wilhelmsson document. Accordingly, it is respectfully requested that the rejection of claims 10, 30, 40, and 41 under 35 U.S.C. §102 be withdrawn.

Claims 31-34 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Wilhelmsson in view of Bottomley et al. (WO 01/01594 A) (hereinafter, "Bottomley"). This rejection is respectfully traversed.

Independent claim 31 defines a method of *decision boundary estimation* and soft bit value estimation, whose steps include, *inter alia*:

> running a combiner for M symbols of a channelization code n;
>
> ...
>
> *determining a sample decision boundary estimate* based on the M symbols; and
>
> *updating the decision boundary estimate* based on a variable $d_{\Sigma}^{(n)}$ that sums a sample decision boundary $\hat{d}^{(n)}$ over a time interval corresponding to $M \cdot N$ symbols and on a variable $d_{filter,1}$ that reflects a history of the variable $d_{\Sigma}^{(n)}$.

(Emphasis added)

These steps are both novel and nonobvious over the subject matter described in the Wilhelmsson document at least because, as explained earlier, Wilhelmsson does not disclose any technique for generating decision boundary estimates. Moreover, the Bottomley patent fails to make up for the deficiencies of Wilhelmsson because it too is silent with respect to determining decision boundary estimates. The Office argues that Bottomley discloses "updating the decision boundary... a history of the variable $d_{\Sigma}^{(n)}$" at page 19, lines 11-29. Applicants respectfully disagree because this portion of Bottomley deals only with the generation of weighting factors that are applied when combining first and second combined values y_0, y_1, each of which is itself a combination of correlation values. (See, e.g., page 8,

line 32 through page 9, line 1.) Thus, any combination of Wilhelmsson and Bottomley would also lack at least these claimed elements.

As to claims 32-34, these claims all depend from independent claim 31 and are therefore novel and nonobvious over any combination of Wilhelmsson and Bottomley for at least the same reasons as those set forth above.

For at least the foregoing reasons, claims 31-34 are believed to be novel and nonobvious over the Wilhelmsson and Bottomley documents, regardless of whether these documents are considered individually or in combination. Accordingly, it is respectfully requested that the rejection of claims 31-34 under 35 U.S.C. §103(a) be withdrawn.

The application is believed to be in condition for allowance. Prompt notice of same is respectfully requested.

Respectfully submitted,
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